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SCIENTIFIC AMERICAN SUPPLEMENT

No. 680.

For the Week Ending January 12, 1889.

Price 10 cents. For sale by all newsdealers.

THE DANGER OF ELECTRIC DISTRIBUTION.

Notwithstanding the susceptibility of the public mind to suggestions of alarm, it is doubtful if a full realization of the risk to which the members of the community are exposed from electric wires has been generally attained. If the recent law providing for death by electricity as the punishment of murderers never goes into effect, it will doubtless do its meed of good. It will cause a more thorough discussion of the subject in technical circles, and the idea and true conception of the danger will be disseminated among all.

Electric companies, whether supplying current for lamps or motors, have every inducement to increase the danger inevitably attendant upon their installations. The cheapest wire is the uncoated one. A wire however poorly insulated costs more; a properly insulated one is still more expensive. The quality of the insulation at the start is only one element—its duration when exposed to the weather is another. Insuring the latter gives a further increase in cost. As the network of wires grows thicker, and as the lines cross each other more often, an additional cause of deterioration appears. The contact of swinging wires with one another tends to rub off the insulation and expose the metal. The lines which have done the damage then serve as conductors to carry off the current, possibly to a telephone box or other place where it may do much harm.

Recent experiments in death by electricity which have been made upon animals illustrate the fatal nature of the dynamic shock. In the early days of the science, the static discharge of immense potential and very small quantity was considered the most fatal. It corresponded to the lightning stroke, both in its electrical characteristics and effects. Following the developments of the last decade, dynamic currents of very high intensity are everywhere in use, and these have been found to be deadly, though of comparatively low potential. It is such currents as these that imperfectly protected wires are carrying above the streets. When the dynamos are running, contact with wires conveying such currents is liable to be fatal. A broken wire that has fallen so as to reach from the top of a pole to the street has now come to be regarded as dangerous by the populace. The dread is only too just. Repeated deaths have proved it so.

It is futile to attempt to restrain the march of progress. No advance in practical science is more remarkable than the development of electricity. Goethe's prediction, true for so many years, is now being falsified. He said that electricity would only be applied to the minor uses of life. Now engines are driven by it, and the difficulties in the way of its application to outdoor locomotors are gradually disappearing. The electric light is practically complete in its development. But while no effort should be made to restrict the uses of the current, the fact that it is dangerous should not be overlooked. The rival exploiters of different systems claim each a higher degree of safety, or more properly a less degree of danger, for his own installation. The direct and alternating current advocates are engaged in active attack upon each other on the basis of the relative harmfulness of the two systems. One engineer has suggested a species of electric duel to settle the matter. He proposes that he shall receive the direct current, while his opponent shall receive the alternating current. Both are to receive it at the same voltage, and it is to be gradually increased until one succumbs, and voluntarily relinquishes the contest. The absurdity of the suggestion, which is made in apparent earnestness, shows how decided the war has become. Back of it all the fact remains that the working current of the day, direct or alternating, is dangerous. One solution seems adapted to protect the public. It is to properly dispose of the wires underground.

In examining the effects of the dynamic current upon the systems of animals, several points of interest have been developed. One such point is the small amperage required for a fatal result. Thus, with a current of 536 volts electromotive force a dog with a resistance of 11,000 ohms was killed. This reduces to a current of less than 0·05 ampere, leaving out of consideration the resistance of the dynamo. A horse weighing 1,230 lb. was killed by a current of about 0·06 ampere. In the case of the alternating current, the question of time seems to enter. A current requires a certain period to destroy life, which period varies with the current intensity. These data go to prove how slight a contact with the wires may be fatal. Sooner or later the plan of a modern city will have to provide some effective system of subways. The overhead wires will be a perpetual menace, will be the cause of death and injury.

But a few days have elapsed since a forcible illustration of these dangers occurred. A storekeeper in Meriden, Conn., started to take in some articles of clothing that had been hung up in front of his store. It was raining at the time. He was thrown violently back by an electric shock as soon as he attempted to remove a knit jacket. He soon recovered and continued his work only to receive an additional shock which scorched his hand. The attention of bystanders was excited, and it was found that brilliant flashes of light could be drawn from the iron front of the store. On investigation it was found that an electric light wire had come in contact with the wet awning, and thus had caused the trouble. Here at least is a case where it would be hard for the electric light company to plead contributory negligence.

The Eclipse of the Sun, January 1.

The weather conditions for making good observations seem to have been almost perfect along the line of the total eclipse of the sun, through northern California and Nevada obliquely up through Manitoba, on the first day of the year. Extensive preparations had been made for this work, and a great number of good photographs of the sun's corona have been obtained. Prof. Pickering, chief of the eclipse expedition which had been sent out by Harvard College, telegraphs that their apparatus worked finely, that the corona exhibited great details in its filaments, and that between fifty and sixty photographic negatives were obtained with their telescopes and spectroscopes, eight negatives of the corona being with the great thirteen inch refracting telescope. It is said that a striking characteristic of the corona was two forked wings of light polar rays, well defined. Seven photometric observations were made of the light of the corona during a duration of totality of 118 seconds, the drawings showing that the corona extended outward from the sun two millions of miles. A large and successful party of amateur photographers and astronomers made observations at Cloverdale, Sonoma County. Besides numerous cameras, the observers were equipped with reflectors from Chabot University and a sidereal clock set to automatically record the time. The first contact here occurred at 12:23 P. M., and at 12:46:35 P. M. the corona on the western limb was visible. In from 5 to 7 seconds after, the eclipse was total, totality lasting 104 seconds. The Amateur Photographers' Association took 187 negatives of the corona at different times and with different lengths of exposure. These will be turned over to the Lick Observatory, and the results published as soon as possible. At the Lick Observatory, Professor Holden took thirteen photographs, the sky being cloudy there a portion of the time of the eclipse, and the Lick observing party, under Prof. J. F. Keeler, at Bartlett Springs, Cal., reports having done successful work. Other good work was also done at various points in Nevada and Montana, and at Brandon, a central point in the province of Manitoba. At this point the first contact was observed at 3:15:34 P. M., but the time of the last contact could not be taken, as the sun and moon passed below the horizon together.

Completion of the Great Steel Bridge over the Hudson River at Poughkeepsie, N. Y.

The first engine and car passed over the Poughkeepsie Bridge on December 29 last, when connection with the New York and Massachusetts Railroad was made, the train being in charge of John W. Brock, of Philadelphia, the president of the Manhattan Bridge Building Company. Col. P. P. Dickinson, chief engineer of the Poughkeepsie Bridge Company, who was one of the original projectors of the enterprise and has been connected with it from the first, ran the engine. Among those on board were Charles Cossum, assistant superintendent of the New York Central and Hudson River Railroad; George P. Pelton, president of the New York and Massachusetts Railroad; the Hon. John T. Platt, vice-president of the Poughkeepsie Bridge Company; the Hon. Homer A. Nelson, Hudson Taylor, C. C. Gaines, John F. O'Rourke, engineer of the Union Bridge Company; James B. Platt, C. E. Fogg, J. W. Hinkley, and others.

When the train was seen slowly passing up the east approach, it was greeted by a salute from every part of the city and along the river front on both shores, and multitudes of people gathered to see it cross.

The bridge is of steel, on the cantilever system. There are five river spans, varying from 500 to 521 feet 6 inches each, with head room of from 130 to 160 feet, and two shore spans of 201 feet each. The four river piers are quite narrow, only 25 feet wide. The foundations are 130 feet deep. The cost has been about $2,500,000.

This bridge affords a direct communication between Boston and the regions of New England and the coal mines of Pennsylvania. Illustrations and particulars of this great work are contained in our SUPPLEMENT, No. 646.

New American and British War Vessels.

We publish this week accounts of two new war ships. Of one, the Australia, recently completed in England, we give an engraving. Of the American ship, not yet named and not yet begun, we give a description. The United States vessel is to have a displacement of 4,000 tons and 14½ feet draught; the British ship, 5,000 tons displacement and 19 feet draught. The United States boat is to be a slow tub as to speed, engine power being 5,400 horse power, against 9,200 of the Australia. The armament of the American ship will be the heaviest of any vessel in our navy.

A New War Ship for the U. S. Navy.

The plans for the steel-clad war ship which have just been completed are in several respects among the most novel and interesting of the various designs adopted for our new fleet. In point of size, it is true, she will be surpassed by several of the new vessels. She is to have only about 4,000 tons displacement, while the Maine will displace 6,648 tons; the Texas, even if her original dimensions are adhered to, 6,300; the Puritan, launched many years ago, 6,060; the new armored cruiser provided for at the last session of Congress, 7,500, or nearly double as much as the present coast defense vessel. She will even be surpassed in displacement by the unarmored vessels Chicago, Baltimore, Philadelphia, and the new twenty-knot cruiser, and equaled or surpassed by the Newark and San Francisco. In speed, also, she is not expected to come up to the three new armored cruisers, and while her 5,400 indicated horse power will be quite enough for her purpose, considering her size, it does not look large compared with the 8,000 to be furnished to the Texas and the 9,000 to the Maine. Nevertheless, in the important features of armor and armament she aims at a high standard.

The new vessel adopts the low freeboard principle of the original monitor, thereby securing the possibility of great thickness of armor with comparatively small displacement. She is 250 feet in length between perpendiculars, 59 in extreme breadth, and 14½ in mean draught. Her hull, which has water-tight compartments and a double bottom, is protected by a belt of steel armor sixteen inches thick over the vital parts, which becomes six and eight inches at the extreme ends. This maximum thickness of armor is greater than any yet contemplated on any of our war vessels, and it avails for still greater protection in a vessel of this type, low in the water, and offering a difficult target to the enemy. The armored deck is also three inches thick over the magazines and machinery, and two inches at the ends. The conning tower has ten inches of armor, and the base of the smoke-stack six inches. The bow is strengthened for ramming.

But the armament is still more noticeable. The main battery will have in a forward barbette a 16-inch 110-ton breech-loading rifle, and in the aft barbette a 12-inch 46-ton breech-loading rifle, while a third weapon will be a 16-inch dynamite tube at the bow. The largest gun we now have afloat is the 8-inch, which weighs about 38,000 pounds, and throws a projectile of 250 pounds with about half that weight of powder charge. But the 16-inch rifle, according to the calculations of naval experts, would weigh from 107 to 110 tons, and would throw a projectile of 1,800 to 2,000 pounds with a powder charge of 900 to 1,000 pounds. It is true that several of the other new vessels are to be supplied with 10-inch and 12-inch rifles; but even the latter will weigh only from 44 to 46 tons, and will throw a projectile of 850 pounds with a powder charge of 425. The new coast defense vessel will go at once to the extreme limit of modern heavy ordnance, and will be armed with a gun equal to any now carried by the prodigious vessels of Italy and England. It is true that she will have but one gun of this caliber, while some of the European iron-clads carry four. But she will have a displacement of only 4,000 tons against the 10,600 of the Benbow and the 13,900 of the Italia.

These are the features which give its chief interest and prospective value to the new coast defense ship. The others will be such as the advanced methods of naval construction warrant. Her secondary battery will include fifteen rapid-fire guns of various calibers. Her military mast will be used for signaling, while machine guns and a search light will be placed in the tops. The steering gear, electrical apparatus, and other arrangements will be of the most approved types. This vessel has been the subject of long deliberation, the act of Congress which allowed $2,000,000 to be expended for "floating batteries, rams, or other naval structures" for harbor defense, having been passed nearly two years ago. The result of this deliberation has been at least to secure something quite out of the beaten track of naval designing.—*N. Y. Times.*

SOME INTERESTING OBSERVATIONS OF JUPITER.

During the summer of 1888 I made a good many observations of Jupiter and his satellites and accompanying phenomena. Some of these will, I think, prove of interest to the readers of the SCIENTIFIC AMERICAN. The rapid motion of the satellites around Jupiter causes this wonderful system to present an ever-changing celestial picture of exceeding beauty and interest, when viewed through a powerful telescope. During August, 1888, Jupiter passed very close to several telescopic stars of about the same magnitude as the satellites, so that on one occasion Jupiter presented the remarkable appearance of having *five* moons, and on another evening *six moons.*

Again, on the evening of August 7, there was almost an occultation of a star by Jupiter. This star was first noticed by me on the evening of July 23, when it was about half a degree east of Jupiter, and next on the evening of July 30, in a low power telescopic field. Jupiter and his moons, with the star, presented the arrangement shown in Fig. 1. It must be understood that this is the inverted telescopic view. Jupiter's motion, also appearing reversed, is eastward, as shown by the arrow, and toward the star.

The moons are numbered in the order of their real distances from the planet in all the views, their names being as follows—No. 1 being the nearest to Jupiter:

No. 1. Io.
No. 2. Europa.
No. 3. Ganymede.
No. 4. Callisto.

On the evening of August 2 the moons had so changed their position as to present the appearance shown in Fig. 2. All the moons were on the same side of Jupiter and in a line with the star. The star appeared to be of the same magnitude as satellite 3 (Ganymede), and Jupiter really seemed to be attended by *five* moons.

Fig. 3 presents the interesting configuration of the moons, Jupiter, and the star on the evening of August 4, at 9 o'clock. The change of positions compared with the previous evening is very marked, and the nearer approach of Jupiter to the star very noticeable. The mean of seven measurements with a bar micrometer made the star's place twenty-two and two-tenths seconds of time east of the following limb of Jupiter. The star appeared considerably fainter than satellite 4, Callisto, on this occasion, when farther off it had appeared much brighter.

On the evening of August 6, the appearance was that shown in Fig. 4. The star was just under and very close to satellite 2, Europa, and presented the appearance of a wide double star.

The brightness of the star was only about one-half that of Europa. Micrometer measurements made the star eleven seconds of time east of the following limb of Jupiter on this occasion. The star seemed more than ever to be a part of Jupiter's system, and the whole was a beautiful telescopic picture. The advancing motion of Jupiter upon the star is now very noticeable, and it seems likely that the planet will occult the star.

The star just grazed the lower edge of Jupiter on the evening of August 7, as shown in Fig. 5. The star looked very small and faint in contrast with the superior brilliancy of Jupiter. Only three of the satellites were visible on this occasion, Europa being in transit.

Fig. 6 gives the relative positions the following evening, August 8, when Jupiter had passed to the east of the star. The latter was near the satellite 2, Europa. Three moons only were visible this evening, No. 1 being in transit.

In Fig. 7 I give the appearance of Jupiter's system on the evening of September 11, when all the moons were visible in the order shown, and also a neat double star, so that Jupiter on this occasion presented the remarkable appearance of being attended by no less than *six* satellites.

The observation and study of these grand orbs and their complex motions is most interesting and valuable.

WILLIAM R. BROOKS.

Smith Observatory, Geneva, N. Y., Dec. 28, 1888.

Live Men.

Some men seem never to grow old. Always active in thought, always ready to adopt new ideas, they are never chargeable with fogyism. Satisfied yet ever dissatisfied, settled yet ever unsettled, they always enjoy the best of what is and are the first to find the best of what will be.—*Philadelphia Inquirer.*

A Sugar Refining Deception.

An alleged wonderful discovery, by which raw sugar was almost instantly refined by electricity, the product being a refined sugar of remarkable purity, has for some time past been used to dupe foolish capitalists. It was said the process was non-patentable, and therefore everything about it was kept, in regular Keely style, a profound secret, under lock and key. Only the projector and alleged discoverer of this method of refining were ever allowed to enter the rooms where the work was carried on. And on this basis a company was formed, about $1,000,000 worth of stock sold, for a secret process of refining sugar of which it was said even the great sugar trust, representing all the great refineries, were becoming apprehensive. It now turns out that the whole thing was only an amazing swindle. The projector had at his house, or elsewhere, chemically treated the best refined sugar in the market, so as to make the most pure product possible, in cubes, and had succeeded in introducing tons of this sugar, instead of raw sugar, into the secret room of his factory. In this room he had only the ordinary crushing machinery, of which the outsiders heard the working, and saw the stream of very fine sugar coming out of a spout in another room. And on this they expended their money.

A Million Dollar Telescope.

Representative Butler, of Tennessee, has introduced a bill in Congress to appropriate $1,000,000 to be expended, under the direction of the Secretary of the Navy, in the construction of a great telescope with a lens 60 inches, or 5 feet, in diameter. The diameter of the Lick object glass, the largest in the world, is 36 inches. In view of the fact that many astronomers regarded the success of the great Californian telescope as more than problematical, on account of the difficulty of casting and figuring such huge disks of glass, Mr. Butler's proposition is decidedly startling. But it should be remembered that, thanks to the success of the Paris glass makers and the incomparable skill of our great American telescope makers, the Clarks, the Lick lens has turned out to be so perfect that the croakers have been silenced, and wonder has taken the place of doubt. While it would undoubtedly be an achievement that would tax to the utmost the skill and experience of the artisans and artists who should undertake the work, yet it cannot be said that the construction of a telescopic object glass of 60 inches diameter is impossible.

Such a glass, if successfully made, would be a much greater improvement over the Lick telescope than that great instrument was over the largest of its predecessors. To show this it is only necessary to remember that the light-gathering power of an object glass varies as the square of its diameter. The largest glass before the completion of the Lick lens was the 30 inch telescope of the observatory of Pulkowa. The light-gathering power of the Lick telescope is to that at Pulkowa about as 13 to 9, or one and a half times as great; but the power of a 60 inch lens would be to that of the Lick telescope as 36 to 13, or nearly three times as great. Such a glass would be four times as powerful as the Pulkowa telescope.—*N. Y. Sun.*

Photo. Transparencies.

After fixing the positive, wash it very thoroughly—say for at least an hour—in a constantly changing stream of water, and a final treatment with hydroxyl or one of the hypochlorites in very dilute solution will not be a disadvantage. A solution composed of twenty grains each of chloride of mercury and chloride of ammonium in an ounce of water is next applied, until the image is uniformly whitened throughout its whole thickness, as judged by its appearance from the back of the glass. After that another very thorough washing is necessary, either in a constantly changing stream, or else, after some three or four minutes under a tap, a long soaking of, at least, half an hour, or preferably longer. The washing at this stage cannot be too complete.

Next, for the toning solution. This consists of a solution of moderate strength—say, twenty to fifty grains to the ounce—of sulphide of potassium or "liver of sulphur," the application of which is continued until the desired depth of tint is attained. Potassium sulphide is not a particularly desirable adjunct to the dark room on account of its offensive smell, but so long as there is no sensitive paper, carbon tissue, or similar delicate matter lying about, the inconvenience will end with the smell.

The tones produced under this treatment are of the most pleasing character, ranging through various shades of purple, and are quite independent of the color or character of the image before bleaching. But it must be borne in mind that the final color, after drying, is colder or verges more toward blue than when the picture is wet. This borne in mind, and with a little experience in judging the point at which to stop, no difficulty will be experienced in getting uniform and pleasing tones for transparencies on any good plates.—*Br. Jour. Photo.*